

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Anthony Cyril Lowe Examiner: K. Parker
Serial No.: 09/154,019 Art Unit: 2871
Filed: September 16, 1998 Docket: 11577 (YO998-267)
For: ENHANCED LIGHT-SCATTERING Dated: March 6, 2000
 DISPLAY

Assistant Commissioner for Patents
Washington, DC 20231

DECLARATION PURSUANT TO 37 C.F.R. §1.131

Sir:

I, Anthony C. Lowe, hereby declare that:

1. I am the sole applicant named in U.S. Patent Application Serial No. 09/154,019 filed September 16, 1998.
2. I made the invention which is disclosed and claimed in the present application, in the United States, prior to November 24, 1997, which date is the effective U.S. filing date of U.S. Patent No. 5,929,956 to Neijzen, et al.
3. As evidence of the completion of said invention prior to the effective U.S. filing date of Neijzen, et al. annexed hereto are Exhibits A and B. Exhibits A and B consist of true photocopies of invention disclosures which evidence that the claimed invention was developed in laboratories at IBM Corporation in Yorktown Heights, NY prior to the November 24, 1997 effective U.S. filing date of Neijzen, et al. The activity contributing to the development of the claimed invention was conducted by myself or by other scientists and/or technicians working under my direct supervision and

control prior to the effective U.S. filing date of Neijzen, et al. Dates and names have been redacted in the preparation of the photocopies contained in the attached exhibits.

4. The claimed invention is directed to a display device comprising a structured solid state selectively reflective layer formed inside a display cell, said display cell comprising at least a display transducer, wherein said structured solid state selectively reflective layer transmits light that is not scattered by said display transducer and reflects a portion of light that is scattered in a forward direction by the display transducer towards a viewer. By placing the reflective layer inside the cell, improved backscattering efficiency is obtained, while eliminating parallax between the primary and reflected images

5. Exhibit A is a photocopy of the original invention disclosure which recognized that backscattering efficiency of reverse-mode polymer stabilized cholesteric structure (RM-PSCT) or any other scattering effect liquid crystal (LC) display could be improved by placing a structure, i.e., structured solid state selectivity reflective layer, inside a display device behind the LC layer which transmits light refracted through the display in its transparent state. A description of how to fabricate the claimed display device is provided in the invention disclosure as well as a figure showing the various elements of the claimed invention. Specifically, the figure in Exhibit A illustrates one possible configuration for a display cell in accordance with the present invention that contains a structured solid state selectivity reflectivity layer formed inside the display cell.

As shown, the selectivity reflective layer is formed on a light absorbing layer that is formed on a glass substrate.

6. Exhibit B provides evidence of further development of the claimed invention in which it was proposed to create and then photoreproduce a white light hologram of the array rather than an actual prism.

7. I further declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated:

6 March, 2000

Anthony C. Lowe
Anthony C. Lowe

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1 A

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Invention Disclosure

FULL NAME(S) OF INVENTOR(S)	USER/ORG/DE	EXP. SER.	DIV/DEPT	BLDG/ZIP	LOCATION	TEL. NUM.	FOR USE BY IBM
Anthony C Lowe	LOWE/YKTVMY	050305	RES/750A	10-106	Yerktown	862-3368	
							PATENT ATTY.
							DA
							EVALUATOR
TITLE OF INVENTION (Short & Descriptive) Enhanced Light-Scattering Display							WHERE & WHEN RECEIVED (Time Stamp)
PROBLEM SOLVED BY THIS INVENTION (Summary) The backscattering efficiency of any reflective display which is switched between a transparent and a scattering state is improved by forming a structure on the surface of the rear pixel electrode which transmits light at angles less than the critical angle and totally internally reflects light at angles larger than this.							

BACKGROUND INFORMATION

- 1) To what ☒ IBM Project, ☐ Proposal, ☐ or Product, ☐ or government contract is this invention related? Paper-like Display
- 2) Related and background publications: See References
- 3) Keywords for database search for related work: Display, Reflective, Light-scattering, PDLC, PSCT
- 4) Critical Dates:

INVENTOR ON INTERNATIONAL ASSIGNMENT. Is any inventor of this disclosure in this country on assignment from another country?
☒ YES, ☐ NO. If "Yes", see instruction #5.

DESCRIPTION OF INVENTION - Provide a description (including sketches and diagrams as required). On systems disclosures list significant functions and show where each is accomplished. Programming disclosures need show only a flow-chart and describe what your invention does at the level of the invention.

Assignee Declaration: Anthony C Lowe is an employee of IBM United Kingdom Ltd and a citizen of the UK.

The Problem

Light scattering LC displays have insufficient backscattering efficiency to achieve adequate reflectivity in the white (scattering) state.

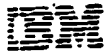
The Invention

The performance of reflective displays which rely on backscattering of incident light to achieve a white state is limited by the backscattering efficiency of the display transducer. Often this will be a liquid crystal such as reverse-mode polymer stabilised

Features: Identify each feature of your invention which you believe is new.

IMPORTANT: Information provided by this form may be used to prepare a patent application which will be signed by the inventor(s). Inventors should take great care in accurately completing this form and in providing full information concerning prior art. False statements or concealment in obtaining a patent will subject applicant to fine and/or imprisonment (18 USC 1001) and may jeopardize the validity of the patent.

WITNESSES: The two witnesses whose signature appear below have read and understood this entire Invention Disclosure:		DISCLOSURE SUBMITTED BY			
Signature of Witness	Date	Inventor's Signature		Date	
		Inventor's Signature		Date	
		Inventor's Signature		Date	
		Inventor's Signature		Date	



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Invention Disclosure- Additional Disclosure Page

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Attach 3 copies of any separate sketches and diagrams)
Description of Invention

cholesteric structure (RM-PSCT) or polymer dispersed liquid crystal (PDLC), to name but two. The backscattering efficiency of RM-PSCT or any other scattering effect LC display can be improved by placing a structure behind the LC layer which transmits light refracted through the display in its transparent state, for which the maximum angle of propagation is the critical angle (about 40°), but reflects light propagating through the display at angles greater than this. In a typical light scattering LC, a fraction of the light is backscattered and the remainder is forward scattered. A portion of the forward scattered light will propagate at angles greater than the critical angle.

This idea has been proposed by Kanemoto *et. al.*, (ref 1), who placed a polymeric prism film behind a PDCL display to achieve the required effect. However, in their device the reflecting film was separated from the plane of the LC layer by more than the thickness of the cell glass and considerable parallax was observed, making the idea unsuitable for high pixel density displays.

The present invention proposes forming a structure with the required properties on the surface of the pixel electrode, avoiding the parallax problem.

The structures required are similar to those in ref 1, but with the following differences:

1. the pitch length (and therefore the thickness) of the structure needs to be reduced to 5µm or less so that a via contact can be made through it to a TFT and the entire structure coated with ITO for optimum performance.
2. the structure must be all solid-state with no air gaps

The structure could also be in the form of square pyramids, rather than ridges, to achieve a symmetrical effect.

The purpose of this disclosure is to describe the idea rather than the means by which it can be reduced to practice, so the following process description is intended to be illustrative rather than definitive. All layer other than the ITO could be solvent-processable

1. Coat the TFT structure with a light absorbing dielectric layer
2. Coat this with a thin layer of transparent dielectric material of low refractive index (about 1.3)
3. Deposit a layer of high refractive index (≥ 1.9) material and transform its surface into the required profile (ridges or pyramids) by photolithography and a suitable etching process.
4. Deposit a planarising layer of low refractive index material over the profiled surface and etch a via to the TFT drain contact

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Signature of Witness	Date	Inventor's Signature	Date
		Inventor's Signature	Date
Signature of Witness	Date	Inventor's Signature	Date
		Inventor's Signature	Date

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(attach 3 copies of any separate sketches and diagrams)

Description of invention

5. Deposit ITO and etch it into the required pixel structure

The Claim

1. A structure in close proximity to the surface of the pixel electrode in a light scattering LCD which transmits light which is not scattered and reflects a fraction of the scattered light
2. A structure in which all the layers are solid state
3. A structure comprised of ridges, pyramids, cones or other suitable shapes
4. A structure where the period is small compared to the pixel dimension, but sufficiently large to avoid diffraction effects
5. A display device in which the pixel electrode is transparent and is deposited on top of the structure
6. A display device in which the pixel electrode is transparent or light absorbing and is formed beneath the structure

Implementation

Not yet

Potential Use

Reflective displays

References

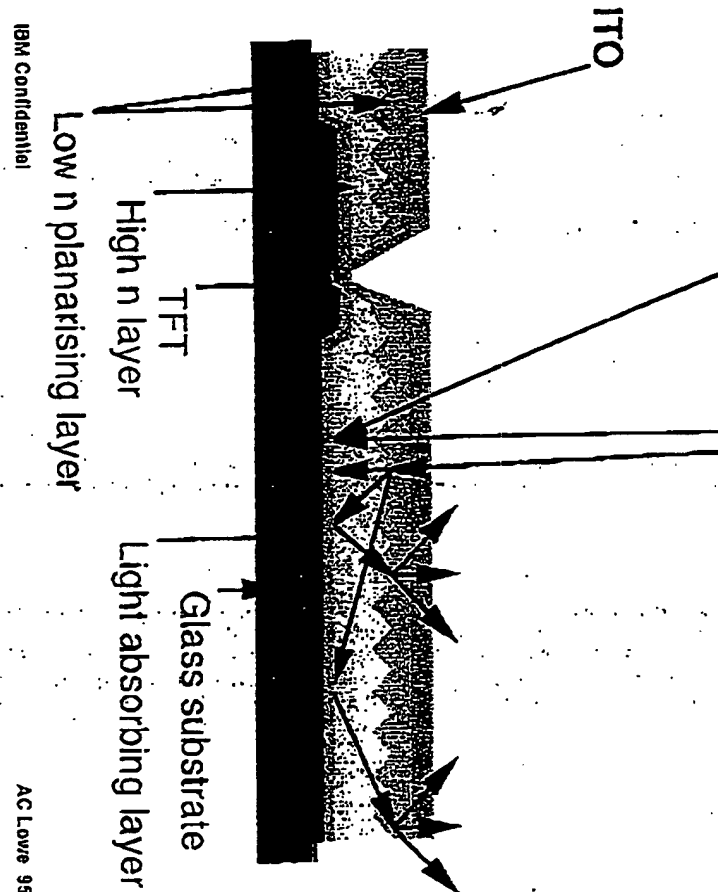
1. A Kanemoto *et. al.*, Conference Record of the International Display Research Conference, 183, (1994).

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		Inventor's Signature		Inventor's Signature	
Signature of Witness	Date	Inventor's Signature	Date	Inventor's Signature	Date
		Inventor's Signature	Date	Inventor's Signature	Date
Signature of Witness	Date	Inventor's Signature	Date	Inventor's Signature	Date
		Inventor's Signature	Date	Inventor's Signature	Date

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Structured Pixel Surface to enhance P-SCT Backscatter



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IBM Invention Disclosure

FULL NAME(S) OF INVENTOR(S)	USERID/NOOE	EMP. SER.	DN/DEPT	BLDG/ZIP	LOCATION	TEL. NUM.	FOR USE BY IP DISCLOSURE NO.
Anthony C Lowe	LOWE/YKTYMV	050305	RES/750A	10-106	Yorktown	862-3368	
							PATENT ATTY.
							EVALUATOR
TITLE OF INVENTION (Short & Descriptive) Enhanced Light Scattering Display (Addendum to Y0895-0070)							WHERE & WHEN RECEIVED (Time Stamp)
PROBLEM SOLVED BY THIS INVENTION (Summary)							

BACKGROUND INFORMATION

- To what ☒ IBM Project, ☐ Proposal, ☐ or Product, ☐ or government contract is this invention related? Paper-like Display
 Related and background publications: None cited
 Keywords for database search for related work: holographic hologram prism_array
 Critical Dates:

VENTOR ON INTERNATIONAL ASSIGNMENT. Is any inventor of this disclosure in this country on assignment from another country?
 YES, ☐ NO. If "Yes", see instruction #5.

DESCRIPTION OF INVENTION - Provide a description (including sketches and diagrams as required). On systems disclosures list significant functions and show where each is accomplished. Inventing disclosures need show only a flowchart and describe what your invention does at the level of the invention.

Assignee Declaration: Anthony C Lowe is an employee of IBM United Kingdom Ltd and a citizen of the UK.

The Problem

The concept is the same as described in the original disclosure. However, rather than create the actual prism structure on the pixel electrode surface, it might prove simpler to create and then photoreproduce a white light hologram of the array:

The purpose of this addendum is to add this concept to the original disclosure.

Features (Identify each feature of your invention which you believe is new).

IMPORTANT: Information provided by this form may be used to prepare a patent application which will be signed by the inventor(s). Inventors should take great care in accurately completing this form and in providing full information concerning prior art. False statements or concealment in obtaining a patent will subject applicant to fine and/or imprisonment (18 USC 1001) and may jeopardize the validity of the patent.

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Signature of Witness	Date	Inventor's Signature	Date
		Inventor's Signature	Date
		Inventor's Signature	Date
		Inventor's Signature	Date

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Description of Invention

The Claim

A structure as in claim 1 of Y0895-0070 in which the layers are in the form of either a surface relief or a volume hologram.
Said hologram could be produced by optical or mechanical means.

Implementation

Several companies are capable of producing the required holograms, but I do not believe this has been done for the present purpose.

Potential Use

In PLDs

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WITNESSES: The two witnesses whose signature appear below have read and understood this entire Invention Disclosure.

Signature of Witness

Date

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Date

Inventor's Signature

Date

Signature of Witness

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Inventor's Signature

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